Oral Sessions

Abstract award winners: The best pre-selected abstracts submitted to the congress: 0420–0423

0420

HIGH GLYCEMIC VARIABILITY INDUCED BY INAPPROPRIATE ALGORITHMS FOR INTENSIVE INSULINOTHERAPY: THE EXAMPLE OF THE NICE-SUGAR STUDY

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INTRODUCTION. Acute hyperglycaemia associated with insulin resistance is common in critically ill patients. Glycemic control with insulin is considered important although the blood glucose target is very controversial. Recently, clinical studies have highlighted the potential negative effects of the variability of the blood glucose concentration in several different cohorts of ICU patients. The aim of the study is to evaluate the glycemic variability induced by the use of the lower range (tight arm) of the NICE-SUGAR (NS) algorithm [1] in comparison with a Proportional-Integral-Derivative controller (PID).

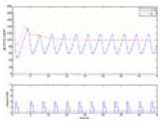
METHODS. We used the minimal model for glycemic control in ICU patients (MM-ICU) developed by van Herpe et al. [2] in order to simulate a virtual ICU patient characterized by the following parameters G_b basal glucose = 101 mg/dL, I_b basal plasma insulin = 20 µUI/ml, body weight BW = 80 kg, ratio to ideal body weight IBW_R = 150%, carbohydrates rate = 150 mg/min, insulin sensitivity index = 2,1 E-3 during 48 h spent in ICU. The lower range of the NS algorithm was set to [80–110 mg/dL] and the target for the PID was 100 mg/dL. All calculations were performed with the MATLAB software. The interval between 2 consecutive measurements resulted from the strict application of the time (without delay) for the next glucose measurement given by the NS algorithm.

RESULTS. Although the strict application of NS requires more blood glucose measurements than PID in these experimental conditions, fluctuations of blood glucose are present during the analysed period with the NS algorithm, whereas blood glucose stabilizes in the target range after only 6 h with the PID.

CONCLUSION. The algorithm used for the patients assigned to undergo intensive glycemic control during the NICE-SUGAR study may induce high variability for some patients. Whether this intrinsic property of the algorithm has contributed to the outcome in the intensive control group of the NICE-SUGAR requires further studies and particularly in respect of the stability margins related to changes in insulin sensitivity during the ICU stay and delays to measure blood glucose in the real life.

1. https://studies.thegeorgeinstitute.org/nice

2. Van Herpe et al (2006) A minimal model for glycaemia control in critically ill patients. Conf Proc IEEE Eng Med Biol Soc. 1:5432–5435 (Fig. 1).



MMICU controlled by PID versus N–S

0421

THE TOTAL HOSPITAL LENGTH OF STAY AND NUMBER OF RENAL IMPAIRMENTS ARE INCREASED BY SEDATION IN CRITICALLY ILL PATIENTS RECEIVING MECHANICAL VENTILATION. A RANDOMIZED PROSPECTIVE STUDY

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INTRODUCTION. The standard treatment of critically ill patients requiring intubation and mechanical ventilation is to sedate the patients [1] and make a daily wake up trial [2]. A natural development in strategies for sedation would be to try to minimize the amount and time the patients spend sedated.

OBJECTIVES. To compare no sedation to a regime with sedation and daily wake up trial, and test the effect on the total hospital length of stay in critically ill patients requiring intubation and mechanical ventilation.

METHODS. Adult patients was included in the study if they required mechanical ventilation for more than 48 h. Patients with increased intracranial pressure were excluded. Patients were randomized to be either awake with bolus doses of morphine (intervention group), or sedated with daily wake up trials (control group). The control group received a continuous infusion of sedation and bolus doses of morphine.

RESULTS. A total of 140 patients were randomized. The two groups were comparable in baseline data. The median Apache II score in both groups was 26 ($P = 0.37$). Patients who received mechanical ventilation less than 48 h was not included in the statistical analysis (27 patients).There was no statistical significant difference in the ICU length of stay between the two groups. The total hospital length of stay were significant lower in the intervention group: 28 days (95% CI 20–43) compared to the control group: 51 days (95% CI 35–63) ($P = 0.02$).The risk of Acute Kidney Injury (AKI) with reduced urine output and increased need of support with vasopressors was increased in the sedated control group. The hospital mortality was also higher in the sedated control group but the difference did not reach statistical significance (20 (36%) vs. 27 (47%), $P = 0.27$).

CONCLUSIONS. No sedation have shown a significant reduction in the total hospital length of stay compared to sedation with daily wake up trials in critically ill patients receiving mechanical ventilation. There was a trend toward higher mortality in the sedated control group. The longer total hospital length of stay in the control group might be explained by the higher incidence of renal failure in the control group.

REFERENCE(S). 1. Jacobi J, Fraser GL, Coursin DB, Riker RR, Fontaine D, Wittbrodt ET et al (2002) Clinical practice guidelines for the sustained use of sedatives and analgesics in the critically ill adult. Crit Care Med 30(1):119–141. 2. Kress JP, Pohlman AS, O'Connor MF, Hall JB (2000) Daily interruption of sedative infusions in critically ill patients undergoing mechanical ventilation. N Engl J Med 342(20):1471–1477

GRANT ACKNOWLEDGEMENT. None.

0422

INFORMATION TRANSFER DURING ICU WARD ROUNDS - ANALYSIS UNDER COGNITIVE PSYCHOLOGICAL ASPECTS

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BACKGROUND. During Ward Rounds on an Intensive Care Unit physicians are confronted with a very high number and denseness of new information every day. The question is wether the human brain is capable of processing this flood of information, or if it exceeds the natural boundaries of human concentration and memory?

METHODS. We conducted a prospective, observational study in the Intensive Care Unit of a university clinic with 18 beds. The information transfer and process of ward rounds was analyzed with the help of video recordings. Alltogether 8 ward round cycles were recorded, each consisting of 4 sequent ward rounds within 24 h in a 3 shift system. In the beginning of each cycle clinically relevant information of 5 patients were established and standadized. This predetermined information served as the default value in order to detect information loss throughout the 24 h. Out of these five patients 2 were chosen from the beginning (randomely chosen from Pat 1–4), one out of the middle (randomely chosen from Pat 8–11) and 2 from the end (randomely chosen from Pat 16–18) of the ward round, in order to find fluctuations in the physicians ability to concentrate and memorize information throughout the ward round, Except for the physician initially passing over the information the rest of the ward round members did not know which patients would be evaluated in the end. To test the physicians memory they were asked to fill out a questionnaire immediately after the ward round had ended on information that was given throughout the ward round.

RESULTS. During the first ward round an average of 15.27 informations were given per patient. Of these only 11.42 (74.79%) were mentioned during the second ward round. During the third ward round only 7.91 (51.80%) of these informations were passed on and 8.30 (54.37%) during the fourth. A major loss of information can be discovered. Of those patients discussed in the beginning of the ward round 69.77% of the information was passed on during the course of 24 h. Of those discussed in the middle only 55.05% and in the end 38.54% of the initial information was passed on, even though the average time needed for each patient remained the same throughout the whole ward round.

CONCLUSION. This shows, that towards the end of the ward round the physicians' ability to concentrate decreased and the density of information lessend. This study shows that the structure of the ward round as it is organized up until now needs to be reconsidered.

REFERENCES. 1. Singh R et al (2006) Disabil Rehab 28:1299–13002. 2. Woloshynowych M et al (2007) Ann Emergen Med 50:407–413. No grants received.

0423

SELECTIVE V_2-RECEPTOR ANTAGONISM AS A NEW THERAPEUTIC APPROACH IN OVINE SEPTIC SHOCK

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INTRODUCTION. The mixed V_1/V_2-receptor agonist arginine-vasopressin (AVP) is increasingly used to stabilize hemodynamics in septic shock. Previous studies have shown that only the V_1-receptor mediates vasoconstriction, while V_2-receptor agonism may increase vascular leakage [1].

OBJECTIVES. The present study was designed as a prospective, randomized experiment to compare the effects of a selective V_2-antagonist [(Propionyl1-D-Tyr(Et)2-Val4-Abu6-Arg8,9)-Vasopressin (TVA-AVP)] with AVP, when given as first-line therapy, on hemodynamics, metabolic changes, mesenteric blood flow and mortality using an established model of ovine septic shock.

METHODS. Twenty-one ewes were anesthetized and instrumented for chronic hemodynamic monitoring. A median laparotomy was performed to take feces from the cecum and to place an ultrasonic flow probe around the superior mesenteric artery under sterile conditions. After baseline (BL) measurements, the feces were injected into the peritoneal cavity. Following onset of septic shock (shock time (ST), defined as mean arterial pressure (MAP) <60 mmHg), the animals were randomly assigned to receive either a continuous infusion of 1 µg kg^{-1} h^{-1} TVA-AVP or 0.5 mU kg^{-1} min^{-1} AVP ($n = 7$ each). The control group ($n = 7$) received only the vehicle (normal saline). Norepinephrine (NE) was titrated up to a maximum of 1 µg kg^{-1} min^{-1} to maintain MAP at 70 ± 5 mmHg in all groups, if needed. Data are expressed as mean ± SEM.

RESULTS. There were no differences at BL and ST between groups. The selective V_2-antagonist led to higher central venous and pulmonary artery occlusion pressures as compared to both other groups ($P = 0.002$ each). Neither MAP, cardiac index, mesenteric blood flow nor NE and fluid requirements differed between treatment groups. Selective V_2-antagonism reduced negative base excess from 2–10 h after ST and attenuated the decrease in pH-values from 2–5 h after ST as compared to both other groups ($P < 0.05$ each). In addition, arterial lactate levels were lower in the TVA-AVP (4.0 ± 0.3 mmol/L) than in the AVP group after 10 h (5.3 ± 0.3 mmol/L; $P = 0.019$). While left ventricular stroke work index was reduced in the AVP group (26 ± 2 g m^{-1} m^2) compared with control animals (37 ± 3 g m^{-1} m^2; $P = 0.01$) after 8 h, there were no statistical significant differences between control and V_2-antagonist treated animals (36 ± 1 g m^{-1} m^2). Notably, selective V_2-antagonism prolonged survival time as compared to AVP (14 ± 1 h vs. 10 ± 1 h; $P = 0.004$) and control animals (10 ± 1 h; $P = 0.004$).

CONCLUSIONS. The selective V_2-antagonist stabilized hemodynamics as effective as AVP without increasing NE or fluid requirements. Since V_2-antagonism does not cause vasoconstriction, an increased intravascular volume due to less capillary leakage might be a possible explanation. In addition, metabolic acidosis was reduced by the selective V_2-antagonist. V_2-antagonism might represent a beneficial therapeutic approach in ovine septic shock.

REFERENCE. 1. Traber DL et al (2007) Crit Care 2007 11:(suppl. 4)

Education and training in intensive care: 0424–0427

0424

CLINICAL SIMULATION: EXPERIENCE IN NURSING EDUCATION

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INTRODUCTION. Clinical simulation allows students to learn and reflect on their own experience, allowing them a new learning and training method which incorporates knowledge, skills and human factors.

OBJECTIVES. To determine the utility of using clinical simulation as a training tool and a method to evaluate clinical competency among nursing students. Moreover to describe the student's opinion on this teaching methodology.

METHODS. During 2007 and 2008, we completed a transversal descriptive study among nursing students (last year of Nursing School) and graduate nursing students during their master's degree on Emergency Nursing. We used a validated survey that evaluated: fidelity of the simulated scenarios, teaching methodology, level of satisfaction, ability to achieve knowledge, attitudes and skills using simulation.

RESULTS. 98.2% of nursing students and 81.4% of graduate nursing students thought that simulation allows to improve their clinical practice and to use the learnt theory. It allows improving teamwork (80.4% students, 69.8% graduate students), safety (89.3% students, 58.1% graduate students), helps to prioritize tasks (32.2% students, 30.2% graduate students) and the implementation of protocols (19.6% students, 23.3% graduate students). All interviewees showed a high degree of satisfaction with this learning tool, meeting all their expectations and they wished to repeat this tool and have more available. The teaching method was considered very useful (100% students and 88.4% graduates students), because it allows to analyze the clinical cases, evaluate the student's attitudes and skills (100% students and 97% graduate students). Fidelity to reality was high (87.5% students, 76.7% graduate students). As negative points the interviewees note: not knowing where things were located during simulation (44.3% students, 11.6% graduate students), stressful scenarios (17.9% students, 13.9% graduate students) and the lack of physicians (0% students, 11.6% graduate students).

DISCUSSION. The majority of interviewees agree that the simulated scenarios were very close to reality. The utility and application on the clinical practice is the most important feature of these tools. The high degree of satisfaction was shown by the agreement among participants. Most of them would repeat the experience and considered that repeating this experience during the training years is crucial for their training. Teamwork and the use of protocols were the most important objectives during the simulated sessions and the most applicable feature in real practice.

No significant differences were found among the two study groups (nursing students and graduate students) regarding satisfaction, utility and expectations with regards to clinical simulation.

REFERENCES. 1. Quesada A et al (2007) Med Intens 31:187–193. 2. Good ML (2003) Med Educ 37(Suppl 1):14–21. 3. Block EF et al (2002) Am Surg 68:648–651. 4. Cooper JB et al (2004) Qual Saf Health Care 13 Suppl 1:11–18

0425

DEPRESSION, BURNOUT AND SUBSTANCE ABUSE IN PRACTICING INTENSIVE CARE PHYSICIANS

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BACKGROUND. Intensive care physicians are exposed to important levels of psychological and physical stress. The working group on Quality of life of the Belgian Intensive Care College studied the prevalence of depression and burnout, as well as the use of alcohol and illicit drugs in intensivists.

METHODS. Belgian intensivists were invited to participate in an electronic survey evaluating demographic variables, work characteristics and career satisfaction. Depression (measured with the Center for Epidemiologic Studies Depression Scale), burnout (measured with the Maslach Burnout Inventory), alcohol use (measured with the AUDIT), and the 12-month illicit drug use were assessed.

RESULTS. 221 intensivists participated in the study (Response rate = 55%). The job as intensivist is satisfactory for 84% of the respondents. Respondents report a high degree of job appreciation by fellow intensivists and patients, but to a lesser extent by other colleagues, or by the hospital management. With regard to quality of life, 63% stated they have not enough time for their family; about 25% met criteria for "possible" or "likely" depression. With regard to burnout, 33% met criteria for a high and 31% for a moderate burnout. For the burnout subscale emotional exhaustion was reported by 15%, loss of empathy by 38% and loss of professional accomplishment by 32%. Excessive use of alcohol was reported in 39% of the respondents, alcohol addiction in 14%. About 4% reported opiate use in the past year; the use of hypnotics and sedatives was common (21%). Four in ten reported moderate and 11% severe problems with sleep quality. Administrative overload and the excessive workload in general were main stressors.

CONCLUSION. Although Belgian intensivists indicated a high level of career satisfaction, a considerable high proportion reports burnout problems, problems with depression, and problematic alcohol use.

0426

NATIONAL SURVEY ON CURRENT PRACTICE OF SEDATION AND ANALGESIA IN INTENSIVE CARE IN UNITED KINGDOM

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INTRODUCTION. Maintaining optimum level of sedation and analgesia can contribute to improved outcome of patients in intensive care (ICU).

HYPOTHESIS. Current practice in UK is not known and is expected to be different from international practice.

METHODS. A proforma was circulated to physicians in 255 general ICU's in UK, enquiring about sedatives and analgesics, guidelines and monitoring methods used in their ICU.

RESULTS. We received 199 responses from 130 ICU's. For short term purpose (<48 h), propofol and midazolam were the commonly used sedatives; morphine and alfentanil were the commonly used analgesics. Remifentanil was used by 15% of physicians. For long term purpose (>48 h), midazolam (82%) and morphine (86%) were commonest sedative and analgesic used followed by propofol (62%) and alfentanil (41%). District general hospitals used more morphine than university hospitals ($P > 0.05$). Written guideline was followed by 64% of physicians; 28% used sedation breaks. Sedation was regularly assessed by 92% of physicians. Ramsay score was the commonest assessment tool used. Compared to American guidelines and practice in Australia or other European countries, alfentanil and to some extent remifentanil were more popular while fentanyl and lorazepam were less frequently used in UK. Written guideline and sedation monitoring were more commonly practiced in UK compared to other countries.

CONCLUSIONS. The current practice of sedation and analgesia in UK was assessed. The practice in UK differed from that followed in other countries in terms of drugs used as well as the extent of use of guideline and monitoring.

0427

INTENSIVE CARE MEDICINE FELLOWS' VIEWS ON PROFESSIONALISM AND HOW THEY LEARN IT

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INTRODUCTION. The emphasis on the importance of professionalism in a recent Co-BaTrICE-IT paper was impressive. However, insight in the elements of professionalism as perceived relevant for intensivists from the fellows' view, and how these are taught and learned, is limited.

OBJECTIVES AND METHODS. A nationwide study was performed. In 2007–2008 all ICM fellows ($n = 90$) were sent a questionnaire containing the following questions regarding training in professionalism (7-point Likert scale (1 = very inadequate, 7 = very adequate)): Which elements are perceived to be important in intensivists' daily practice (38 items, cat. I)? Which methods of learning and teaching are *recognised* (16 items, cat. II)? Which methods of teaching and learning are considered especially *useful* (16 items, cat. III)? Finally, the perceived quantity and quality of formal and informal learning methods, as well as the responsible organisational body was studied. Data were analysed using SPSS 15.0.

RESULTS. Response was 75.5% ($n = 68$), mean age 34 years. Regarding Elements, scores on virtually *all* items were high. The factor 'striving for excellence' explained half the variance. Two other aspects, 'Teamwork' and 'Dealing with ethical dilemmas', were identified. Regarding Methods, three dimensions, 'formal curriculum', 'private and academic experiences' and 'role modelling', proved important. The factor 'formal curriculum' explained most of the variance. Regarding Usefulness the same factors emerged with variance now mainly explained by the factor Private and academic experiences. In both categories the items 'observations in daily practice' and 'watching television programmes like ER and House' were the highest and lowest scoring items (5.99 and 5.81, and 2.69 and 2.49, respectively). Mean scores regarding the quantity of formal and informal teaching were 4.06 and 4.58 (range 1.841 and 1.519). For the quality of teaching figures were 4.22 and 4.52 (range 1.659 and 1.560, respectively). 54 suggestions for improvement of teaching were documented. The need for some form of formal teaching of professionalism aspects as well as for feedback was most frequently mentioned ($n = 19$ and 16). The local training centres are considered and should remain pivotal for teaching professionalism issues ($n = 17$ and 28).

CONCLUSIONS. Almost all elements of professionalism were considered relevant for intensivists' daily practice. Although formal teaching methods regarding professionalism aspects are easily recognised in daily practice, learning by personal experiences and informal ways quantitatively plays a more important, and more valued role. Qualitative comments nevertheless stress the need for providing and receiving (solicited and unsolicited) feedback, thereby requesting expansion of formal teaching methods. The local training centres (should continue to) play a major role in teaching professionalism, although an additional role for the (inter)national intensive care organisations remains.

Sepsis: Current insights in supportive and adjunctive therapies: 0428–0432

0428

EFFECTS OF A CORRECT USE OF RECOMBINANT HUMAN ACTIVATED C PROTEIN IN PATIENTS WITH SEPTIC SHOCK

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BACKGROUND. The indications to recombinant human Activated C Protein (rhACP) in patients with septic shock have been clearly defined in the Surviving Sepsis Campaign (SSC) guidelines [1]. Nevertheless, in the clinical practice rhAPC is often used out of indications and only in few of the patients with indications [2]. The aim of this study was to evaluate the effects of a correct use of rhAPC on the survival rate of patients with septic shock.

METHODS. In 83 patients with septic shock admitted to a Surgical Intensive Care Unit (ICU) from January 2005 to December 2008 we collected age, site of infection, SOFA and SAPS II scores, 30 days and Hospital mortalities and the application of 5 resuscitation and 4 management interventions: blood cultures before antibiotics, antibiotics within 3-h, source control, adequate fluid resuscitation, SvO_2 optimization within 6-h, glycaemia control, steroids use, rhAPC administration and plateau inspiratory pressure <30 cm H_2O. The interventions were classified as completed or non completed; an intervention not applied because non applicable was defined as completed. For analysis, patients were subdivided in patients with compliance (group C) and without compliance (group NC) to rhAPC indications of the SSC guidelines.

RESULTS. rhAPC indications were fully respected in 61% ($n = 51$) of the patients (group C). In this group, rhAPC were not administered in 25 patients because of contraindications. In the NC group ($n = 31$), 4 patients received rhAPC out of indications and rhAPC was not used in 27 patients with indications. Age, severity scores and sites of infection were similar in group C and NC. Similarly, the compliance to resuscitative and management intervention was comparable in the 2 groups, apart the steroids use that was larger ($P < 0.05$) in C group (71% patients) than in NC group (44% patients). Thirty-days as well as Hospital mortality were lower ($P < 0.05$) in C group (27% and 43%) than in NC group (56% and 69%).

CONCLUSIONS. A correct application of the SSC guidelines for rhAPC use strongly increased the survival rate of septic shock patients compared to patients without respect to SSC indications.

REFERENCES. 1. Dellinger RP, Carlet, JM, et al (2008) Surviving sepsis campaign guidelines for management of severe sepsis and septic shock. Intensive Care Med 34:17–60. 2. Bertolini G, Rossi C, et al (2007) Use of Drotrecogin alfa (activated) in Italian intensive care units: the results of a nationwide survey. Intensive Care Med 33:426–434

0429

PREDICTING THE EFFICACY OF RHAPC DURING INFUSION?

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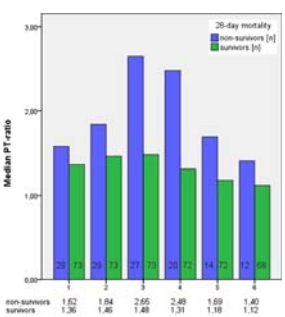
INTRODUCTION. Recombinant human activated protein C (rhAPC) has been proven to reduce the mortality of severely septic patients. The recommended dose is 24 mg/kg/h for 96 h. However, no study demonstrates that 96 h infusion of rhAPC is the optimal duration.

OBJECTIVES. The aim of this study was to analyze which parameters can predict the efficacy of rhAPC during infusion.

METHODS. Patients treated with rhAPC for severe sepsis in our ICU between December 2001 and April 2009 were analyzed. The assessed variables were prothrombin time (PT), activated partial thromboplastin time (APTT), platelets, PaO2/FiO2 ratio, inotrope dose, APACHE II and SOFA scores. The most deviating values were taken in the following time windows: ICU admission (T1), ICU admission to start of infusion (T2), day 1 (T3), day 2 (T4), day 3 (T5) and day 4 (T6) of rhAPC infusion. Because the PT reference values changed during the study period, a PT ratio defined as the maximum PT value divided by the upper limit of normal was used as an indicator of thrombin generation. The endpoint was 28-day mortality. The data was analyzed by Student's *t*-test, logistic regression and repeated measurements as appropriate. Data are represented as mean ±SD or median and range as appropriate. A P value < 0.05 was considered significant.

RESULTS. Among 104 patients analyzed, 30 patients died within 28-days (29%). At baseline, the PT ratio did not differ between survivors and non-survivors. However, non-survivors showed a significant rise in PT ratio on the first day of rhAPC infusion, whereas no such rise was found in survivors. The area under the curve of the PT ratio over time was significantly larger in non-survivors ($P < 0.03$). In the logistic regression analysis, a PT ratio ≥2.0 on the first day of rhAPC infusion was the only independent predictor of 28-day mortality, with and odds ratio of 3.83 (95%CI 1.9–5.4, $P < 0.0001$).

CONCLUSION. A PT ratio ≥2.0 on the first day of rhAPC infusion was an independent predictor of 28-day mortality in severely septic patients treated with rhAPC, suggesting that the efficacy of rhAPC can be predicted by the change in prothrombin time on the first day of infusion (Fig. 1).



Graph

0430

PROGNOSTIC INTEREST OF PLASMA PROTEIN C MEASUREMENT IN SEVERE SEPSIS OR SEPTIC SHOCK

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If administration of activated protein C (APC) during septic shock was shown to reduce mortality, its use is still very debated. Some studies have shown that a low plasma level of protein C (PC) was related to poor outcome and might be used as a marker to indicate APC treatment.

AIM. To confirm the prognostic interest of plasma PC on a large homogenous population of severe septic patients; to test the association with sepsis severity, inflammatory markers, coagulation parameters, comorbidities and treatment with APC.

METHODS. PC concentration measured in plasma at D0 (within 24 h after 2nd organ failure), D1, D2, D7, D14, D21 and D28 by immunofluorescence (Triage®, Biosite, Inverness Medical France) in severe septic patients having at least 2 organ failures. Following items were collected: severity: SAPS II and SOFA; systemic inflammation markers: monocytes HLA-DR expression, plasma IL-10, IL-12 and MIF; coagulation parameters: PT, Platelets; comorbidity and treatments.

RESULTS. 109 patients (63 [52–75] y/o; 65/35% M/F; 80% receiving catecholamines; SAPSII D0 46 [36–56], SOFA D0 7 [6–9], median [IQR]) were studied. Overall D0-D28 evolution of PC concentration did not differ between alive and dead patients (D28 mortality). Focusing on the early phase, PC level at D1 but not D0 was significantly different between alive and dead patients (D28 mortality, $P = 0.04$ univariate analysis). Then a PC gradient (D1-D0; time delay = 20 [17–24] h) > 0 was associated with a significantly better outcome than a PC gradient < 0 (HR = 2.13 [1.05–4.31] $P = 0.04$]). PC gradient was associated with SAPS II at D0 (Pearson correlation coefficient −0.21 [−0.39–−0.02], $P = 0.03$), but not with SOFA, and tended to be linked with renal failure (77 patients (70%) (Somers Dxy -0.254, $P = 0.06$), but not with coagulation tests. Only D0 PC level was associated with PT (0.46 [0.28–0.59] $P < 0.0001$) and monocyte HLA-DR expression (0.20 [0.01–0.38] $P = 0.03$). No relation between PC level or PC gradient with comorbidity was observed. Importantly, PC level did not change homogenously in the 5 patients receiving APC.

CONCLUSION. If the measured plasma concentration of PC does not relate to outcome, the early (<24 h) determination of plasma PC gradient in severe sepsis might help to define high mortality risk. It might then help to guide the use of APC, but does not seem to inform well on APC responders or not.

0431

COMPARING TWO DIFFERENT ARGININE VASOPRESSIN DOSES IN ADVANCED VASODILATORY SHOCK: A RANDOMIZED, CONTROLLED TRIAL

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INTRODUCTION. Arginine vasopressin (AVP) can restore hemodynamic stability in advanced shock states poorly responsive to standard catecholamines. A randomized controlled trial found no beneficial effects of AVP on overall outcome [1] but only in patients with less severe septic shock [1] and those simultaneously treated with corticosteroids [2]. So far, it is unclear in which dose AVP should be administered and if dose dependent effects on hemodynamic function and adverse effects exist.

OBJECTIVES. To compare the effects of two arginine vasopressin (AVP) dose regiments on the hemodynamic response, catecholamine requirements, AVP plasma concentrations, organ function and adverse events in advanced vasodilatory shock.

METHODS. In this prospective, randomized, controlled, open-label trial fifty patients with advanced vasodilatory shock either due to sepsis, systemic inflammatory response syndrome, or cardiac surgery requiring norepinephrine >0.6 μg/kg/min were included. Patients were randomized to receive a supplementary AVP infusion either at 0.033 or 0.067 IU/min. Demographic, clinical and outcome data were collected in all patients. The hemodynamic response to AVP, catecholamine doses, laboratory, endocrinologic and organ function variables, as well as adverse events (decrease in cardiac index or platelet count, increase in liver enzymes or total bilirubin) was recorded before, 1, 12, 24 and 48 h after randomization. A mixed effects model was used to compare data between groups.

RESULTS. Heart rate and norepinephrine requirements decreased while MAP increased in both groups. Patients receiving AVP at 0.067 IU/min required less norepinephrine ($P = 0.006$) and milrinone ($P < 0.001$) than those receiving AVP at 0.033 IU/min. Arterial lactate levels and base deficit decreased while arterial pH increased in both groups. Patients in the 0.067 IU/min group had lower plasma troponin levels ($P = 0.03$) and base deficits ($P = 0.03$) than patients in the 0.033 IU/min group. AVP plasma levels increased in both groups (both $P < 0.001$) but were higher in the 0.067 IU/min group ($P < 0.001$). The rate of adverse events during AVP infusion was comparable between groups. Mortality was not different between groups (0.033 IU/min, 52%; 0.067 IU/min, 52%; $P = 1$).

CONCLUSIONS. A supplementary AVP infusion of 0.067 IU/min restores cardiovascular function in patients with advanced vasodilatory shock more effectively than AVP at 0.033 IU/min. Future trials including more patients are warranted to evaluate the effects of AVP at 0.067 IU/min on the overall outcome of patients with advanced vasodilatory shock secondary to systemic inflammation.

REFERENCES. 1. Russell JA, Walley KR, Singer J, et al (2008) Vasopressin versus norepinephrine infusion in patients with septic shock. N Engl J Med 358:877–887. 2. Russell JA, Walley KR, Gordon AC, et al (2009) Interaction of vasopressin infusion, corticosteroid treatment and mortality of septic shock. Crit Care Med 37:811–818

0432

COMPARISON OF VASOPRESSIN- VERSUS NOREPINEPHRINE-ASSOCIATED ISCHEMIC ECG CHANGES IN SEPTIC SHOCK

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INTRODUCTION. There is concern that vasopressin may increase myocardial ischemia when used in the treatment of septic shock.

OBJECTIVE. To compare rates of ischemic ECG changes in vasopressin and noradrenaline treated patients who had septic shock and were enrolled in the VASST study [1].

METHODS. Patients who had septic shock were randomised to receive a blinded infusion of low-dose vasopressin or norepinephrine in addition to open-label vasopressors. The ECG substudy was carried out in 8 centres who participated in the VASST study. Patients who had a 12-lead ECG at baseline and at least one further ECG within 4 days were included. ECGs were analysed independently and in duplicate by a cardiologist and an intensivist blinded to treatment allocation. Definitions of abnormalities and a checklist were provided to the two readers. Ischemia was defined as present if identified in at least two analyses. Categorical variables were analysed using the chi-square test and continuous variables using the *T*-test. Multivariate regression analysis was used to adjust for age, APACHE II, sex, ischemic heart disease and dose of norepinephrine at baseline.

RESULTS. 103 patients and 366 ECGs were included. The mean age was 62.8 ± 16.8 years, mean APACHE II 28.5 ± 7.5, 76 (73.8%) were male, and 53 patients were treated with vasopressin and 50 patients with norepinephrine.

18 patients (17.5%) developed new ischemic changes. Patients who developed ischemia were older 70.7 v 61.2 years ($P = 0.03$), had higher APACHE II scores 33.8 v 27.3 ($P = 0.001$) and had a trend to a higher 28-day mortality rate 58.8 v 36.5% ($P = 0.1$). There was no difference in rates of ischemic ECG changes in the vasopressin group compared to the norepinephrine group (18.9 v 16.0%, $P = 0.8$). On multivariate analysis the vasopressin group had an OR for ischemic changes of 1.49 (95%CI 0.48–4.6) (Table 1).

TABLE 1 ECG ABNORMALITIES REPORTED IN ALL ISCHEMIC ECGS

	Vasopressin ($n = 53$)	Norepinephrine ($n = 50$)
Patients with any ischemic changes	10	8
AF/Flutter/PSVT	3	1
Bundle branch block	0	0
Q waves	1	1
ST changes	10	7
T wave inversion	5	2

CONCLUSIONS. Ischemic ECG changes were common (17.5%) but there was no difference in occurrence between vasopressin and norepinephrine treated patients in this VASST substudy.

REFERENCE. 1. Russell JA et al (2008) NEJM 358(9):877–887

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Experimental AKI, electrolyte disturbance: 0433–0437

0433

FUNCTIONAL, MORPHOLOGICAL AND CYTOCHEMICAL CHANGES IN A LARGE ANIMAL RECOVERY MODEL OF POST CARDIOPULMONARY BYPASS ACUTE KIDNEY INJURY

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OBJECTIVE. Acute kidney injury (AKI) post cardiac surgery is associated with mortality rates approaching 60%. The pathophysiology is poorly understood and clinical outcomes have improved little over the past two decades. The development of effective treatments is hindered by the poor homology between rodent models, the mainstay of research into AKI, and that which occurs in humans. The aim of this study was to characterise post cardiopulmonary bypass (CPB) AKI in an animal model with potentially greater homology to cardiac surgery patients.

METHODS. Adult White-Landrace pigs (50–70 kg, $n = 24$) were randomised in a 1:1 ratio to either 2.5 h of cardiopulmonary bypass or sham procedure. Perfusion pressure, central venous filling pressure and hydration were standardised. Endpoints included serial functional and biochemical measures of AKI. All pigs were recovered for 24 h prior to nephrectomy and histological assessment of tubular damage, inflammation and endothelial activation.

RESULTS. Baseline measures of porcine renal function were within normal ranges for adult humans and similar between groups. CPB was associated with a 18% reduction in glomerular filtration rate (mean difference 27.9 (95% CI 6.2–49.5) ml/min, $P = 0.016$) as determined by Cr51 EDTA clearance, a 27% reduction in creatinine clearance (mean difference 44.6 (95% CI 6.3–82.9) ml/min, $P = 0.026$), a 68% reduction in free water clearance (mean difference 52.5 (95% CI 10.6–94.3) ml/min $P = 0.018$) and a 66% reduction in fractional sodium excretion (mean difference 3.2 (95% CI 0.8–5.6)%, $P = 0.012$) when compared to controls at 24 h. These changes are similar to those reported in clinical studies evaluating the effects of CPB on renal function. CPB was also associated with an 86% increase in intrarenal levels of the vasoconstrictor adenosine (mean difference 0.079 (95% CI 0.025–0.132) nmol/mg protein, $P = 0.007$). There was a modest increase in urinary protein:creatinine ratio post CPB, however this did not reach statistical significance (mean difference 268.93 (95% CI −70.9–608.8) mg/mmol, $P = 0.11$). CPB resulted in significant changes in renal tubular morphology with marked renal tubular dilatation, tubular epithelial necrosis, accumulation of cell debris within the tubular lumen, and a moderate inflammatory cell infiltrate. AKI was associated with endothelial injury, as evidenced by reduced dBA lectin staining and reduced excretion of urinary nitric oxide, and endothelial activation, as demonstrated by increased endothelin-1 and VCAM staining.

CONCLUSIONS. This novel porcine model of post-CPB AKI links functional, biochemical and histological measures of kidney injury and demonstrates significant homology to AKI in cardiac surgical patients. We propose that this model be explored as a platform for the development of novel renoprotective strategies in cardiac surgery. Endothelial activation may represent a therapeutic target in the prevention of AKI.

0434

ERYTHROPOIETIN (EPO) ATTENUATES ACUTE RENAL DYSFUNCTION IN A PORCINE MODEL OF ISCHEMIA-REPERFUSION INJURY

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BACKGROUND. Erythropoietin (EPO), well known for its role in promoting erythrocyte survival, has recently been shown to be a potent protector of ischemic injury in various organs systems. Multiple protective effects of EPO, such as antiapoptotic and antioxidant have been demonstrated, however the anti-inflammatory effects of EPO in ischemic-reperfusion (I/R) injuries are not known. The aim of the present study was to evaluate the effect of EPO on the renal I/R injury and to characterize the immunomodulatory effects.

METHODS. Twenty-four pigs (30–35 kg) were anesthetized and mechanically ventilated. The pigs were randomized into one of three groups (1) I/R + EPO (5000 I.E/kg) $n = 9$ (2) I/R + placebo, $n = 9$ and (3) sham, $n = 6$. I/R was induced by clamping the left renal artery for 45 min followed by 4 h of reperfusion. The Glomerular Filtration Rate (GFR) was estimated bilaterally by Cr-EDTA clearance hourly. Arterial and renal venous blood samples were collected simultaneously for measuring renal oxygen consumption and plasma cytokines (IL-1β, TNF-α, IL-6, IL-8 and IL-10). Renal biopsies were obtained for analyzing cytokine content and apoptosis was evaluated by histology and immunohistochemistry for caspase-3.

RESULTS. EPO markedly attenuated the renal dysfunction induced by I/R. During reperfusion the GFR in the EPO group was significantly higher compared to the placebo group ($P < 0.01$). There were no hemodynamic differences between the groups and we found no differences in renal blood flow or renal oxygen consumption between the I/R-groups. The cytokine and histology analyses are ongoing and will be presented.

CONCLUSION. This experimental porcine study demonstrates that EPO is effective in attenuating renal I/R injury estimated as GFR. The mechanism was not related to changes in renal blood flow or hemodynamics. Whether the effects correlates to changes in the inflammatory response or the degree of tubular apoptosis will be discussed as the analyses are completed.

0435

THE BH4 PRECURSOR SEPIAPTERIN RESTORES RENAL MICROVASCULAR OXYGENATION AND PREVENTS RENAL INJURY AFTER ISCHEMIA-REPERFUSION IN RATS

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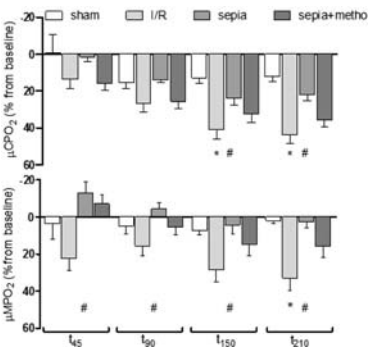
INTRODUCTION. Renal oxygenation depends on a balance between oxygen supply and consumption. Endothelial nitric oxide synthase (eNOS)-derived nitric oxide (NO) is a major factor for adequate microvascular and oxygen consumption regulation after ischemia-reperfusion (I/R). Decrease of BH4 bioavailability, an essential cofactor for eNOS, can impair eNOS activity after I/R. In this study we hypothesis that administration of sepiapterin, the essential precursors for BH4, restores renal oxygenation following I/R.

METHODS. Rats were randomized in 4 groups: sham group, ischemia-reperfusion (I/R) group, I/R + sepiapterin, precursor of BH4, I/R + sepiapterin + methotrexate, inhibitor of the dihydrofolate reductase which converts sepiapterin to BH4. Cortical ($C\mu PO_2$), and outer-medullary ($M\mu PO_2$) microvascular oxygen pressure, renal oxygen delivery(DO_{2ren}), renal oxygen consumption(VO_{2ren}) and renal oxygen extraction(O_2ER) were measured using dual-wavelength oxygen-dependent quenching phosphorescence techniques during 30 min of ischemia and throughout 3 h of reperfusion. Renal function was assessed with creatinine clearance. MPO staining was used to assess leukocytes activation and infiltration.

RESULTS. During reperfusion following ischemia, renal arterial resistance increased while renal blood flow, $C\mu PO_2$ and $M\mu PO_2$ decreased. I/R induced a drop of both cortical ($C\mu PO_2$) and outer medullary ($M\mu PO_2$) microvascular PO_2 by ∼44% and 34% respectively ($P < 0.01$ vs. sham both) together with a decrease of DO_{2ren} and an increase of O_2ER. Treatment with sepiapterin was associated with a higher DO_{2ren} and lower VO_{2ren}. RBF decreased by 11% in the sepiapterin group ($P = 0.05$ vs. I/R). Sepiapterin significantly increased both $C\mu PO_2$ and $M\mu PO_2$ compared to the I/R group. Sepiapterin partially inhibited increase of O_2ER (31% at t_{210}, $P < 0.001$ vs. I/R). Treatment with methotrexate reversed the effect of sepiapterin on O_2ER back to values of the I/R group (Fig. 1).



Microcirculatory CPO2 changes (% from baseline) in

CONCLUSION. Supplementation with the precursor of BH4, sepiapterin, can prevent microvascular hypoxia after renal I/R and prevent renal injury. Sepiapterin could therefore be a potential treatment for prevention of ischemic-induced acute kidney injury.

0436

SYSTEMATIC SEARCH FOR UNEXPLAINED IATROGENIC HIGH ANION GAP METABOLIC ACIDOSIS IN A LARGE COHORT OF ICU PATIENTS

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INTRODUCTION. Metabolic acidosis frequently occurs in ICU patients, for example as lactic acidosis or diabetic ketoacidosis. Less frequent causes may be the accumulation of organic acids as may be induced by various drugs. We systemically searched for patients with a sustained high anion gap metabolic acidosis (HAGMA). The contribution of lactate and ketones and potentially offending drugs was studied.

OBJECTIVES. To determine in how many ICU patients there might be an iatrogenic cause for their sustained HAGMA.

METHODS. In our hospital database we screened all arterial blood gas analyses that were performed in the ICU over a 7 year period for pH <7.20 and a base excess <−10 mmol/L. In order to identify patients with sustained acidosis 24 h means were calculated before further analysis. The anion gap (AG; normal range 8–16 mmol/L) was calculated from sodium, chloride and bicarbonate. 50 patients with the highest anion gap were examined in detail for potential causes, including organ failure and drugs associated with HAGMA.

RESULTS. In 20,186 consecutive ICU admissions (hospital mortality 11%) with 203,043 blood gas analyses (BGA), we found 500 patients who exhibited 794 episodes of sustained severe metabolic acidosis. The AG could be determined in 510 (64%) episodes. The mean ± SD anion gap in the 50 patients with the highest anion gap was 31.2 ± 5.8 mmol/L. 6 patients (12%) presented with acetaminophen or organic acid intoxication, 6 other patients (12%) were admitted after reanimation and diabetic keto-acidosis was present in 3 (6%). Contributing causes in admitted patients were lactic acidosis in 36 cases (72%), sepsis in 29 (58%) and renal failure in 32 (64%). We found that the HAGMA in all these cases could be explained by already known causes.

CONCLUSION. Our data suggests that all patients with a HAGMA had identifiable causes, although minor iatrogenic contributions could be present. The leading cause was lactic acidosis associated with sepsis and multi-organ failure. In 41 patients (82%) the cause was multifactorial, mainly including renal failure and sepsis.

0437

EPIDEMIOLOGY AND PROGNOSTIC IMPACT OF ACQUIRED HYPERNATREMIA IN CRITICALLY-ILL PATIENTS: A MULTICENTER COHORT STUDY

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INTRODUCTION. ICU-acquired hypernatremia has been poorly studied to date and may be considered as an iatrogenic event reflecting quality of care [1]. Hypernatremia has been described as associated with atelectasis, neurological impairment, hyperglycaemia and negative myocardiac inotropic response. Objective of this study was to describe prevalence and prognosis impact of ICU-acquired hypernatremia.

METHODS. Prospective observational multicenter cohort study performed in twelve intensive care units. Patients admitted for more than 48 h between 1997 and April 2008 in the participating ICUs were included.

Mild hypernatremia was defined as a natremia >142 mmol/L and severe hypernatremia as a natremia >148 mmol/L.

ICU-acquired hypernatremia was defined as a hypernatremia occurring after 1 day of ICU stay.

RESULTS. 8,441 patients were included in this study. 826 were secondarily excluded because of a hypernatremia at ICU admission. Of the 7,615 remaining patients, 1,598 (21%) developed a mild hypernatremia and 590 (7.7%) a severe hypernatremia. Mild and severe ICU-acquired hypernatremia occurred respectively 4 days [IQR 2–7] and 6 days [IQR 3–9] after ICU admission.

Factors independently associated with occurrence of an ICU-acquired hypernatremia in a Fine and Gray model [2] were male gender, severity at ICU admission as assessed by the SAPSII score, septic shock, acute respiratory failure or coma as reason for ICU admission and treatments during the first 24 h following ICU admission (namely presence of a bladder catheter, of a central venous catheter, needs for vasopressors, needs for steroids and treatment by antibiotics). Unadjusted hospital mortality in patients without, with mild and with severe ICU-acquired hypernatremia was of respectively 14.5%, 22.8% and 39.4% ($P < 0.0001$). When evaluating ICU-acquired hypernatremia as a time-dependent variable in a subdistribution hazard model [2], sub-distribution hazard risk (SHR) for ICU mortality was of 2.82 [95%CI 2.48–3.21; $P < 0.0001$]. After adjustment for confounders, both mild and severe ICU-acquired hypernatremia were independently associated with mortality with a SHR of 1.30 [95%CI 1.10–1.52, $P = 0.002$] and 1.69 [95%CI 1.39–2.04; $P < 0.0001$] respectively.

CONCLUSION. ICU-acquired hypernatremia is frequent and associated with a poor prognosis after adjustment for confounders. This was true even for ICU-acquired hypernatremia of mild severity (142–148 mmol/L). Although no firm conclusion can be made regarding mechanisms of this prognostic impact, ICU-acquired hypernatremia may reflect quality of care in critically-ill patients.

REFERENCES. 1. Polderman KH et al (1999) Crit Care Med 27:1105–1108. 2. Beyersmann J et al (2008) Biostatistics 9:765–776

Quality care: 0438–0442

0438

QUALITY OF EMOTIONAL AND COGNITIVE RECOVERY AFTER LOWER ACUITY CRITICAL CARE ADMISSION

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INTRODUCTION. Admission to a Critical Care Unit (CCU) can frequently result in significant psychological problems afterwards. It has been reported that up to 66% of survivors can be affected in some way. In the local critical care population the published incidence seems to be about 45%.

Many Critical Care Follow-Up (CCFU) clinics were established in the early 1990s to identify and deal with these issues. Almost all discussion about the benefits of CCFU is focused around the needs of the most severely ill (level 3) critical care patients. There is currently no published data specific to the lower acuity level 2 critical care patients in this area.

OBJECTIVES. To define the long term sequelae of critical care admission for lower acuity (Level 2) patients in the setting of as service based in a tertiary level cancer centre.

METHODS. Patients were offered CCFU if there was a medical cause of admission or if they had stayed for greater than 3 days. Appointments were made for 3–4 months post discharge from CCU.

Upon invitation to attend, 3 questionnaires are sent out to fill in. They were the Hospital Anxiety and Depression scoring tool (HAD), the Trauma screening questionnaire (TSQ) and a physiotherapy screening tool. These were used to lead the consultation and direct therapy at the time.

The tools were then retrospectively analysed for a two year period (March 2007–March 2009) to examine the incidence of Anxiety and depression and post traumatic stress syndrome in this cohort.

RESULTS. A total of 92 patients were offered CCFU: 26 (28%) declined the offer and a further 9 (10%) did not attend. 3 (3%) had died prior to the appointment date and 3 (3%) were inpatients at the tiem of the CCFU appointment.

Of the 51 that were seen in the CCFU 23 (45%) were male and 30 (59%) had a medical cause of admission. Fully completed questionnaires were available for 46 (Tables 1, 2).

TABLE 1 HAD SCORES

HAD score	0–7	8–10	11–21
Anxiety (*n* (%))	32 (69%)	5 (11%)	9 (19.5%)
Depression (*n* (%))	28 (61%)	9 (19.5%)	9 (19.5%)

TABLE 1 TSQ SCORES

TSQ score	0	1–3	4–6	7–10
Number (%)	11 (24%)	14 (30%)	12 (26%)	9 (20%)

Other cognitive symptoms following discharge from CCU were of hallucinations in 12 (26%). 28 (59%) patients complained of being unable to concentrate since discharge and 23 (50%) had a lasting loss of memory for the duration of their CCU admission.

CONCLUSION. Despite being admitted to a lower acuity CCU, these patients suffer from high rates of emotional and cognitive problems afterwards. 30.5% score positive for anxiety, 39% for depression and 20% score positive for post-traumatic stress syndrome. This is similar to those of the more severely ill Level 3 population.

The high rate of cognitive symptoms in this patient group is interesting. Traditionally these symptoms are related to the use of sedative infusions however none of our patients was either invasively ventilated, nor had sedative infusions during their stay.

0439

ICU DIARIES REDUCE POSTTRAUMATIC STRESS DISORDER AFTER CRITICAL ILLNESS: A RANDOMISED, CONTROLLED TRIAL

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INTRODUCTION. We have previously showed that delusional memories from ICU were a major contributor to the development of post traumatic stress disorder (PTSD) [1]. We subsequently confirmed this in a European study, showing an average PTSD incidence of 10% [2], often precipitated by delusional recall. We now hypothesised that an ICU diary could be used as a form of cognitive behavioural therapy to help patients come to terms with their memories and so reduce the incidence of PTSD.

METHODS. A prospective randomised, controlled study was performed in 12 ICUs across 6 European countries. Included criterion was ≥72 h stay in ICU. 1 week after ICU discharge the ICU Memory Tool [3] was used to identify recall for delusional memories and patients were screened for a history of previous psychological problems. 1 month post ICU discharge the level of PTSD related symptoms was assessed using the PTSS-14 [4] and the patients were randomised to receive their diary at this point or after the next interview 3 months post ICU discharge. At this point, the assessment of PTSD was repeated and a definitive diagnosis of PTSD was made using a diagnostic interview, the PDS [5]. After the final interview, the control patients also received their diaries.

RESULTS. 352 patients were randomised, 322 (91.5%) completing the 3 month follow-up. 11 patients with undiagnosed, pre-existing PTSD were excluded from the final analysis. The incidence of new PTSD in the intervention group was 5% (8/154), and 13.4% (21/157) in the control group; this was statistically significant (Fisher's Exact test 6.15, df 1, $P = 0.013$). Patient feedback about the diaries was very positive with most of the intervention patients receiving the diary at the 1 month follow-up and reading it a median of 3 times (0–20 range). 148 (84%) patients said that others had read the diary, most commonly the family (100%), friends (36%), colleagues (5%) and health care staff (4%). Only 1 patient had not read the diary.

CONCLUSION. This randomised, controlled trial confirms that the simple provision of an ICU Diary with appropriate photographs helps patients come to terms with psychological sequelae from their critical illness and significantly reduces the development of PTSD.

REFERENCES. 1. Jones C, Griffiths RD, Humphris GM (2008) Memory 8(2):79–94. 2. Jones C, Bäckman C, Capuzzo M et al (2007) Intens Care Med 33(6):978–985. 3. Jones C, Humphris G, Griffiths RD (2000) Clin Intens Care 11(5):251–255. 4. Twigg E, Humphris G, Jones C et al (2008) Acta Anaesthesiol Scand 52(2):202–208. 5. Foa EB et al (1997) Psychiatric assessment 9:445–451

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0440

SURVEY OF PAIN ASSESSMENT PRACTICES FOR CRITICALLY-ILL PATIENTS UNABLE TO SELF-REPORT PAIN

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INTRODUCTION. Pain assessment of the critically ill is challenging due to frequent inability to self-report associated with altered consciousness level, sedation, endotracheal intubation and the complex, dynamic nature of the intensive care environment.

OBJECTIVE. To describe critical care nurse pain assessment practices for patients unable to self report before systemic introduction of a pain assessment tool.

METHODS. Self-administered questionnaire sent to all nurses employed in 5 ICUs of a quaternary academic center. Survey items were generated from systematic literature review, existing assessment tools, and expert opinion. Items examined assessment tool use, assessment frequency, perceived utility of various behaviours derived from existing tools for pain assessment, and perceived importance of pain assessment for patients unable to self-report. Face and content validity were assessed by a multidisciplinary panel of 10 pain experts.

RESULTS. Response rate was 57% (141/247). Most respondents (118/141, 84%) perceived nurses as most accurate at identifying pain presence for patients unable to self-report, 17/141 (12%) perceived relatives, and none perceived physicians as most accurate (not reported [NR] 6/141 [4%]). A formal pain assessment tool was used by 64/141 (45%) nurses with the 4 most commonly used tools being the Behavioural Pain Scale (Payen) (29/141 [21%]), Adult Nonverbal Pain Scale (Ohdner) (22/141 [16%]), Critical care Pain Observation Tool (Gelinas) (20/141 [14%]) and Pain Behaviour Assessment Tool (Puntillo) (19/141 [13%]). More than 1 tool was used by 38/141 (27%) nurses. Of the nurses not using a tool, 51/77 (66%) described the method used to determine pain presence; 32/51(63%) assessed vital signs in combination with various pain behaviours, 7/51 (13.5%) vital signs only, 5/51 (10%) pain behaviours only, and 7/51 (13.5%) via agitation in combination with vital signs and behaviours.

Most nurses (81/141, 57%) assessed pain ≤4 hourly (H), 47/141 (33%) >4–≤8H, 10/141 (7%) every 12H or prn (NR 3/141 [2%]). Frequent pain assessment was considered extremely important by 68% (96/141), moderately 23% (32/141), and somewhat important 7% (10/141), (NR 3/141 [2%]). Use of a standardized assessment tool was rated extremely important by 55% (78/141) moderately 28% (40/141), somewhat 12% (17/141) and minimally important 3% (5/141) (NR 1/141 [1%]). Behaviours most frequently considered routinely indicative of pain were grimacing (88/141, 62%), vocalization (78/141, 55%) and wincing (73/141, 52%). Behaviours most frequently considered as seldom or never indicative of pain included: not following commands (77/141, 55%), climbing out of bed (66/141, 47%) and coughing during ventilation (63/141, 45%).

CONCLUSIONS. Formal pain assessment tools were not used by most nurses. Some descriptors found in validated behavioural pain assessment tools were not consistently perceived as indicative of pain.

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0441

DELIRIUM INCIDENCE AND CONSEQUENCES IN CRITICALLY ILL PATIENTS

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INTRODUCTION. Smaller studies indicate that delirium is a serious and frequent psycho-organic disorder in the ICU with high morbidity and mortality rates. Although several significant risk factors are known for ICU patients, its health consequences are not completely clear. We performed an extensive study to investigate the incidence rate of delirium, the importance of the risk factors, and the health consequences of delirium.

METHODS. A prospective cohort study in a 33-bed medical-surgical and neurological intensive care unit for adult patients. The CAM-ICU was performed 3 times a day and used as delirium assessment tool.

RESULTS. 2116 consecutive patients admitted between February 2008–2009 were screened, of which 501 patients were excluded because of ICU admission time less than 12 h ($n = 44$), sustained coma ($n = 132$), unable to understand Dutch ($n = 24$), delirious before admission ($n = 134$), severely mentally disabled ($n = 32$), suffering from receptive aphasia ($n = 37$), or other ($n = 135$). Of the 1615 patients 411 patients developed delirium (Table 1), 16% had a hyperactive type, 36% a hypoactive type and 49% an alternating type of delirium. Median duration time of delirium was 2 days [IQR 1–7], for the hyperactive type this was 1 day [IQR 1–1.5], for the hypo active type 1 day [IQR 1–4] and for the alternating type 5 days [IQR 1.5–16]. Of all delirious patients 88% were mechanically ventilated of which 68% were ventilated at the time of the onset of delirium. After multivariate analysis of the significant risk factors the most important risk factors for delirium were coma (OR 4.80, CI-95% 3.1–7.5), infection (OR 2.9, CI-95% 2.0–4.3), sedation (OR 1.4, CI-95% 0.9–2.2), admission type: trauma (OR 4.6, CI-95% 2.5–8.5), neurology/surgery (OR 4.1, CI-95% 2.5–6.7), and urgent admission (OR 1.7, CI-95% 1.2–2.4). Although delirious patients had a higher APACHE II, the occurrence of delirium was an independent predictor of morbidity rates, i.e. re-intubation (2.5% vs. 0.004% in non-delirious patients), removal of catheters (5.9% vs. 0.004%), time on the ventilator (8.7 vs. 0.7 days), ICU (11.1 vs. 1.7 days) and hospital (30.6 vs. 13.2 days) length of stay, and hospital mortality (4.5% vs. 2.5%); all $P < 0.0001$.

CONCLUSION. In this large delirium study, we confirm that delirium is a frequent and serious health problem especially in trauma, neurological and urgent admitted ICU patients. The occurrence of delirium plays a more important role in increasing morbidity rates than the severity of illness at ICU admission. With the mapping of the delirium risk factors in this study it is now possible to build a delirium prediction model (Table 1).

TABLE 1 ADMISSION TYPE AND DELIRIUM INCIDENCE

Admission type	Incidence rate (%)
Medical ($N = 361$)	42.9
Surgical ($N = 1011$)	15.0
Trauma ($N = 80$)	90.5
Neurology/surgery ($N = 163$)	68.0
Planned ($N = 761$)	10.6
Urgent ($N = 854$)	38.2

0442

PRESSURE INJURY PREVENTION DURING NON-INVASIVE RESPIRATORY ASSIST IN INTENSIVE CARE PATIENTS. INOTROPES IS A STRONG RISK FACTOR FOR DEVELOPING SKIN LESIONS FROM FACIAL MASKS

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INTRODUCTION. Intensive care patients requiring non invasive respiratory assist often develop some form of pressure damage in the face [1]. This may cause suffering and pain during the therapy and also later, in form of scars disfiguring the face. Pressure damages that are allowed to develop into full-scale can lead to a need of extended care. Since non-invasive ventilatory assist is a step towards a shorter time of care, the aim of this study was to see how to eliminate the pressure injuries in this patient group and thus bring down the time of care and maintain a good comfort for the patients.

METHOD. All patients over 10 years of age requiring non-invasive respiratory assist were included in the study during a period of 6 months. The Norton Scale [1, 3] was used for inspection of the patient's skin and the results were documented by the treating staff in the department. Data on patients' weight, length, size of CPAP mask, postexpiratory pressure (PEEP) used, type of nutrition, and if the patients required treatment of inotropic agents were collected and analysed. S-Transtyretine was measured for detecting malnutrition [2].

RESULTS. 110 intensive care patients were treated with non invasive ventilation using a face mask. Mean treatment time was 381 min with a range of 120–720 min. 79 patients (71.8%) developed skin lesions grade 1 after mean 116 min (range 45–180 min). 35 patients progressed to skin lesions grade 2 after mean 171 min (range (60–250 min).

There was no significant difference in PEEP or pressure support between the patients who developed grade 1 or grade 2 skin lesions 5,4/6,0 and 5,1/6,0 PEEP/PS respectively. However of the patients who developed grade 2 skin lesion 33 of 35 (94%) were on vasoactive drug infusion. Only 2 patients out of 75 (2.7%) had ongoing vasoactive treatment in the group with none or grade 1 lesions. No patients had signs of malnutrition.

CONCLUSIONS. Patients treated with inotropic agents because of circulatory instability are much more sensitive for pressure injury and should be carefully and regularly observed for pressure injuries, during noninvasive ventilatory assist.

It is important to start up the non-invasive treatment with low pressure, i.e. a PEEP not more than 4 mmHg and a pressure support not higher than 5 mmHg. If higher pressure is required, the pressures should be increasing slowly during the treatment. An optimization of the ventilatory mask fit on the face of patients with pressure ulcers prevention material before treatment starts and the right size of mask used to prevent leakage is of high importance.

REFERENCES. 1. Haniffa, M Lasserson, TJ, Smith I (2004) Interventions to improve pressure wounds with positive airway pressure 6:18. 2. Laurells Klinisk Kemi (2007) Nutrition 3:228. 3. European Pressare Ulcer Advisory Panel - Norton scale (2006)

Risk assessment from ED to the first ICU day: 0443–0447

0443

RISK ASSESSMENT IN THE FIRST 15 MIN: A PROSPECTIVE COHORT STUDY OF A SIMPLE PHYSIOLOGICAL SCORING SYSTEM IN THE EMERGENCY DEPARTMENT

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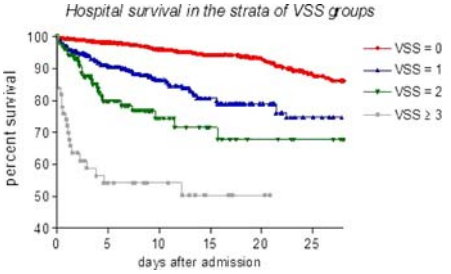
INTRODUCTION. Various scoring systems have been proposed for identification of critically ill patients in emergency departments (ED) at risk of serious deterioration but outcome studies applying these triage systems are scarce. Most ED do not apply a structured approach to detect vital sign abnormalities, but rely on the overall clinical impression to identify these patients. It unknown whether the use of formal scoring is better than the subjective impression of the first health care provider in the recognition of patients at risk of poor outcome.

OBJECTIVES. To evaluate a scoring system based on readily available physiological parameters after admission to an ED and to compare its prognostic value to a rating based on the clinical impression of the attending medical staff.

METHODS. Prospective observational cohort study including all emergency admissions of adult patients over a period of 6 months. Physiological criteria were collected prospectively in the first 15 min after ED admission. Occurrence of each of seven potential vital sign abnormalities (threat to airway, abnormal respiratory rate, low oxygen saturation, low systolic blood pressure, abnormal heart rate, low GCS and seizures) was considered as one point, the vital signs score (VSS) was defined as the sum of all points. Additionally, the admitting staff rated all admissions on a scale ranging from 0 (no immediate concern) to 10 (maximum immediate threat), representing an overall rating of the subjective perceived instability of the patient (concern rating score, CRS).

RESULTS. Study data were available for 3140 patients. VSS (chi-square 188.2; $P < 0.0001$) was the most accurate predictor of hospital mortality in the survival analysis. Only VSS showed statistically significant survival differences over the whole score range (Fig. 1). The CRS was also a predictor of hospital mortality (chi-square 77.2; $P < 0.0001$), but its prognostic value was inferior to VSS. After the exclusion of patients with high CRS (scores 7–10), the CRS lost its predictive value (OR 1.20, 95% CI 0.98 to 1.46, $P = 0.081$).



Hospital survival in the strata of VSS groups

CONCLUSIONS. VSS scores collected in the first 15 min after admission to the ED allow for simple identification of patients at risk of an unfavourable outcome during the subsequent hospital stay. Their accuracy in predicting hospital mortality was superior to a simultaneously collected score based on the overall clinical impression of the attending medical staff.

0444

NISS BETTER THAN ISS TO PREDICT MORTALITY IN PENETRATING TRAUMA BUT NOT IN DAMAGE CONTROL LAPAROTOMY

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OBJECTIVE. Despite the wide use of ISS as a predictive score, several reports have shown that ISS is a poor predictor of outcome especially in patients with severe penetrating injuries. More recently, the use of New ISS {NISS (defined as the sum of the squares of the AIS the patient's three most severe AIS-90 injuries, regardless of the body region)} has been compared with ISS in blunt severe trauma. The purpose of this study was to evaluate the performance of NISS and ISS in patients with penetrating trauma, both in conventional and DC laparatomy.

METHODS. Consecutive adult patients over a 6-years period with penetrating trauma and surgery were identified in our prospective trauma single center registry. NISS was estimated retrospectively. Logistic regression was used to construct ROC curves and areas under the curve (AUC) in order to compare the discriminative capacity among scores by type of surgical approach.

RESULTS. A total of 214 patients with penetrating trauma were identified, 93 (43.4%) needed DC surgery.

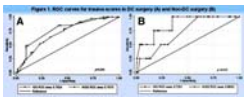
Mean age for DC group was of 32.3 ± 10 years old, RTS was 6.2 ± 1.9, and 30 days mortality was of 35.5%. Compared with non-DC patients with mean age of 30.3 ± 10.9 years old, RTS was 7.1 ± 1.2 and 30 days mortality of 3.3% (Table 1, Fig. 1).

TABLE 1 MEAN AND AUC ISS VERSUS NISS

Score Mean values and AUC for scores, by surgical approach

	DC Group			Non-DC group		
	Mean(SD)	AUC	95%CI	Mean(SD)	AUC	95%CI
ISS	24.3 (10.9)	0.76	0.67, 0.86	17 (9.5)	0.72	0.51, 0.93
NISS	42 (14.3)	0.71	0.60, 0.81	25 (13.7)	0.86	0.70, 1.0

NISS and ISS AUC were 0.86 and 0.72, respectively ($P = 0.01$), for non-DC group; and 0.71 and 0.76 in DC group (Fig. 1)



ROC curves for trauma scores in DC surgery (**a**) and non-DC surgery (**b**). AUC_ISS versus NISS

CONCLUSION. NISS showed an improved performance for mortality prediction over ISS in the subgroup of patients with non-DC surgery for penetrating trauma, but not in DC setting. Furthermore, overall performance of the scores was sub-optimal in this setting. More efforts have to be made to identify new prognostic factors for this subgroup of very ill patients.

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0445

NOVEL MODELS FOR THE PREDICTION OF HOSPITAL MORTALITY AFTER TRAUMATIC BRAIN INJURY REQUIRING CRITICAL CARE

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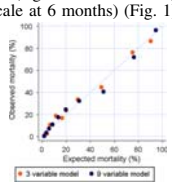
INTRODUCTION. Previous studies have demonstrated that existing risk prediction models perform adequately for predicting acute hospital mortality for admissions to critical care units in the UK following acute traumatic brain injury (TBI). However, further improvements in model performance may be achievable by developing specific models for this patient group.

OBJECTIVES. To develop risk prediction models for critical care admissions with TBI using routine data from general risk models.

METHODS. Data were extracted from the Case Mix Programme Database for 625,925 admissions to 192 adult, general critical care units and neurocritical care units in England, Wales and Northern Ireland from 1995 to 2008. Admissions following TBI were identified by a primary reason for admission of Primary brain injury, Subdural haematoma, or Extradural haematoma. Fifteen variables, identified a priori as being predictive of mortality after severe head injury, were included in a logistic regression model. The model was simplified in a stepwise manner, with the least significant variable removed at each step until no variables remained. Two different cut points were selected to define two models: a more complex model, suited to research and detailed audit; and a simple model, suitable for use at the bedside.

RESULTS. 10,866 admissions following TBI to 173 units (170 general critical care units and 3 neurocritical care units) were included in the analysis. Two models were defined: a nine-variable model (age, GCS, pupil reactivity, intracranial mass effect, mean arterial pressure, temperature, heart rate, glucose, coagulation) and a three-variable model (age, GCS, pupil reactivity). Both models showed good discrimination (area under the ROC curve: 0.881, 95% CI 0.867–0.894; and 0.866, 0.851–0.881) and good calibration (Figure), and out-performed general critical care risk prediction models.

CONCLUSION. This study has developed two models, a simple three-variable model and a complex nine-variable model, that discriminate between hospital survivors and non-survivors better than existing risk models for admissions to critical care following TBI. Further potential exists to improve on these models by considering other factors specific to TBI not included in routine data collection (e.g. CT classification), and evaluating longer-term outcomes (e.g. Glasgow Outcome Scale at 6 months) (Fig. 1).



Calibration of the risk models

0446

ADMISSION SOURCE TO A TERTIARY INTENSIVE CARE UNIT: CAN AN ADMISSION FROM A WARD BE A PREDICTIVE FACTOR OF MORTALITY?

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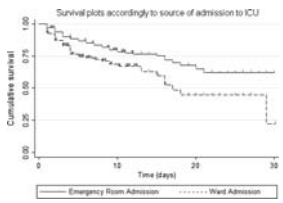
INTRODUCTION. In the literature there is some evidence suggesting that ward transfers to ICU have a poorer severity-adjusted outcome than those admitted directly [1, 2, 3, 4].

OBJECTIVES. The aim of our study was, considering as reference an admission from the emergency room (ER), to understand the impact in mortality of an admission from a ward, independently of the physiological condition (SAPS II).

METHODS. Single center retrospective study from a pool of 792 patients admitted during 2007 and 2008 in a 12 bed mixed tertiary ICU. We randomly selected 498 patients, divided in 2 groups: Group I: 138 patients admitted from an non-ICU hospital ward (90: from our hospital ward and 48: from other hospital ward); Group II: 360 patients admitted from ER. Statistical analysis: χ^2, Mann–Whitney, unpaired *t*-Student, Cox-regression.

RESULTS. The age of patients admitted from the ward was significantly higher than those admitted from the ER (60.4 ± 18.2 vs. 52.1 ± 19.7, $P < 0.01$). The ward admissions presented in the ICU with higher SAPS II (47.6 ± 17.35 vs. 42.5 ± 15.5, $P < 0.01$), SOFA at 24 h (7.9 ± 4.3 vs. 6.4 ± 3.7, $P < 0.01$), and SOFA at discharge (5.9 ± 4.7 vs. 4.6 ± 3.6, $P < 0.01$), compared with ER admissions. Ward admissions experienced higher ICU mortality (34.78 vs. 18.33%, $P < 0.01$) with the survivors staying longer in the ICU when compared with ER admissions. The most frequent causes for admission of patients admitted from the ER were multiple trauma (26.39%), neurologic disease (includes traumatic brain injury without multiple trauma) (22.78%) and septic shock/severe sepsis (15.56/11.1%). Septic shock/severe sepsis (50.72/23.19%) and hypovolemic/cardiogenic shock (4.35/2.90%), were the most frequent causes for ICU admission from a ward. The crude risk of death during the ICU stay was 77% higher in the ward admission group (Hazard ratio: 1.77, 95%CI: 1.21–2.27) (see graph.). Adjusting for SAPSII, the risk of death was still 47% higher in the ward admission group (Hazard ratio:1.47, 95%CI: 1.00–2.15) (Fig. 1).



Survival plots accordingly to source of admission to ICU. Ward versus ER ICU-admission (survival KM curve)

CONCLUSIONS. We concluded that admission from a ward has an independent impact in mortality and outcome. We alert for the important role of the warning scores for earlier identification and treatment of ward patients (frequently associated to failure of previous therapies) who are at risk for deterioration and subsequent transfer to the ICU (1,2).

REFERENCES. 1. Crit Care Med (2005) 33:705–710. 2. Journal of Crit Care (2007) 22: 290–295. 3. Crit Care Med (2003) 31:1981–1986). 4. Ann Intern Med (2003) 138:882–890

0447

AN ASSESSMENT OF THE RIFLE CRITERIA TO PREDICT HOSPITAL MORTALITY 24 H AFTER ADMISSION TO AN INTENSIVE CARE UNIT

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INTRODUCTION. Since its introduction in 2004 the RIFLE criteria for the classification of Acute Kidney Injury has been extensively validated [1]. Recently a number of studies have investigated the ability of the RIFLE criteria as a tool to predict mortality [2–4]. No studies have investigated the ability of the RIFLE criteria to predict mortality at 24 h following admission to an intensive care unit (ICU).

OBJECTIVES. To assess the ability of the RIFLE criteria to predict hospital mortality 24 h after admission to an ICU.

METHODS. We retrospectively reviewed all adult admissions to a 15 bedded medico-surgical ICU over a 5 year period from 1st January 2003 to 31st December 2008. Patients under 16 years and readmissions to the ICU were excluded. Baseline creatinine and the highest creatinine concentration 24 h after admission to ICU was used to classify patients according to RIFLE criteria into 4 groups: Normal, Risk, Injury and Failure. Multivariable logistic regression analysis was used to assess the relationship between RIFLE category and hospital mortality. 5090 patients were included in the analysis.

RESULTS. 8% of patients were classified were classified under the Risk, Injury and Failure categories. Overall hospital mortality was 27.4%. There was a linear increase in hospital mortality from Normal to Failure (Normal 26.6%, Risk 33.9%, Injury 44.6% and Failure 52.2%). The unadjusted Odds Ratio (95% Confidence Interval) revealed the RIFLE criteria to be an independent predictor of hospital mortality; Risk 1.4 (1.1–1.8), Injury 2.2 (1.4–3.5), Failure 3.0 (1.3–6.9). However after adjusting for age, sex, APACHE II score, Mechanical ventilation and Specialty this relationship was no longer significant; Risk 0.8 (0.6–1.1), Injury 1.2 (0.7–2.1), Failure 1.8 (0.7–4.6).

CONCLUSION. There was a linear relationship between crude hospital mortality and RIFLE category. The adjusted Odds Ratio did not reveal a relationship between RIFLE category and hospital mortality in this study. However the wide confidence intervals would dictate that this relationship warrants further investigation in larger prospective studies. RIFLE criteria may indeed prove to be an important mortality prediction tool as early as 24 h after admission to ICU.

REFERENCES. 1. Bellomo R, Ronco C, Kellum JA, Mehta RL, Palevsky P, ADQI Workgroup (2004) Acute renal failure- definition, outcome, measures, animal models, fluid therapy and information technology needs: the Second international concensus conference of the acute dialysis quality initiative (ADQI) Group. Critical Care 8:R204–R212. 2. Uchino S, Bellomo R, Goldsmith D (2006) An assessment of the RIFLE criteria for acute renal failure in hospitalised patients. Crit Care Med 34:1913–1917. 3. Ostermann M, Chang RW (2007) Acute kidney injury in the intensive care unit according to RIFLE. Crit Care Med 35:1837–1843. 4. Kellum JA (2008) Acute kidney injury. Crit Care Med 36:S141–S145

At the boarder of the ICU: 0448–0452

0448

THE DEVELOPMENT OF AN INTENSIVE CARE UNIT (ICU) TRIAGE SCORE

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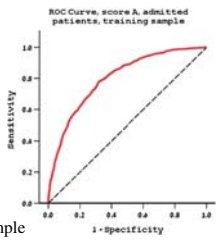
INTRODUCTION. Scoring systems were developed for prognosticating ICU mortality but none for ICU triage.

OBJECTIVES. To develop an ICU triage score

METHODS. Prospective, observational study of triage decisions performed in 11 ICUs in 7 European countries from 9.03 to 2.05 of all patients (pts) >18 with ICU admission requests to develop a triage score. Demographic, lab and data from other scores were collected. Separate scores for accepted and rejected pts with 28-day mortality endpoint were built. Values for variables were grouped into categories determined by the LOWESS graphical method applied to the logit of the mortality and by univariate logistic regressions for reducing candidates for the score. Multivariate logistic regression was used to construct the final scores. Cut-off values for 99.5% specificity were determined.

RESULTS. Of 8472 triages there were 7737 pts. The ROC admission curve is below (Fig. 1).



ROC curve, score A, admitted patients, training sample

The admission score included age, SBP, DBP, respirations, sodium, creatinine, diagnosis, billirubin, PaO2, bicarbonate, vasopressors, Glasgow coma score, Karnofsky Scale, operative status and chronic disorder. The refusal score included similar variables. Any patient with an admission score >173.5 or refusal score = 0 should be rejected.

CONCLUSIONS. The admission and refusal scores provide objective data for rejecting pts that will die even if admitted to ICU and survive if refused ICU admission.

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0449

THE IMPACT OF CRITICAL CARE RESPONSE TEAM INTERVENTION ON END OF LIFE CARE

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BACKGROUND. DNR (Do Not Resuscitate) order is an important aspect of medical practice; few studies from Arab, Muslim countries are addressing this issue due to cultural, educational and religious characteristics of the area. Critical care response team (CCRT) has been utilized to rapidly manage seriously ill patients outside intensive care unit (ICU). Initiating DNR is a key part of CCRT activity.

PURPOSE. We compare the DNR practice before and after implementing CCRT.

METHODS. Our hospital is 900 bed tertiary care center. CCRT has been launched in Jan 1st 2008. The CCRT is 24/7 service led by in-house North American certified Intensivist. Cohort analysis of prospectively collected data of 634 CCRT activation from January 1st 2008 to September 30th 2008.

Data before implementation of CCRT was available for 299 patients from the period of June 1st 2007 to December 31st 2007. A comparison was made for the 2 groups (before and after implementation of CCRT) for demographic data and percentage of patients in whom DNR order was initiated.

RESULTS. *Before CCRT implementation* 299 patients reviewed by ICU service 41.1% females and 58.9% males with mean of age 58.44 ± 18.47 SD (standard deviation). The outcome of 299 patients 61.8% transferred to ICU, 35.5% managed in the floor and DNR was initiated in 2.7% of patients.

After CCRT implementation a total of 634 CCRT activations 44.3% females and 55.7% males with mean of age 57.89 ± 20.31 SD. The CCRT activation outcome was 47.6% transferred to a critical care area, 44.4% managed in the floor and DNR initiated in 10.0% of cases. There was 7.3% increase in DNR order after CCRT has been introduced to our hospital.

CONCLUSION. CCRT plays an important role in addressing and initiating DNR for those patients seen in the medical floor preventing unnecessary ICU admission.

The reason for increase in DNR order after implementation of CCRT is the early call of CCRT with the earliest physiologic derangement of patients giving more time to discuss with the primary team about the DNR status of the patient.

0450

INTENSIVE CARE PHYSICIANS IN AUSTRIA CONSIDER ADVANCE DIRECTIVES AS HELPFUL TOOLS IN END-OF-LIFE DECISIONS

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INTRODUCTION. Particularly in situations of medical futility, broadening the responsibilities of intensive care medicine to palliative care is increasingly requested. As many of our patients are unconscious or otherwise incapable of expressing their wishes, end-of-life decisions can only be based on the patients′ presumable will. Advance directives could counterbalance this lack of information.

OBJECTIVE. The aim of this survey was to evaluate the experiences of Austrian intensive care physicians with advance directives two years after implementation of a new advance directive legislation in Austria.

METHODS. Under the aegis of the OEGARI (Austrian Society of Anaesthesiology, Resuscitation and Intensive Care) an anonymised questionnaire dealing with quantity and quality of advance directives in the last two years was sent to the medical directors of all intensive care units in Austria.

RESULTS. 241 questionnaires were sent and 139 received, equivalent to a response rate of 57.7%. About two-thirds of the responders reported at least little experience with advance directives. Up to one-fifth of the doctors reported conflicts arising due to the existence of an advance directive, concerning their own ethical values, within the treatment team and also with the patients′ relatives. Regarding refused resuscitation and life supporting therapy intensive care physicians kept to the directives in nearly 100%, in cases of refused ventilation or alimentation the percentage was about 80%.

CONCLUSION. A responding rate of almost 60% proves the increasing interest of intensive care professionals in making patient-oriented end-of-life decisions. Knowing the patients′ actual will does not exclude conflicts regarding therapy limitation and discontinuation. Nevertheless, the majority of the intensivists considers advance directives as a helpful tool to deal with this delicate issue.

0451

WITHDRAWAL OF EXTRACORPOREAL MEMBRANE OXYGENATION (ECMO) IN PATIENTS WITH REFRACTORY CARDIAC FAILURE: A MULTICENTER SURVEY

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The aim of the study was to assess the conditions of ECMO withdrawal in patients with refractory cardiac failure and contraindicated for heart transplantation (HT) or ventricular assist device (VAD).

METHODS. A questionnaire was mailed out to 15 French intensive care units that practice ECMO. The questionnaire contained: 1) informations on ECMO practices: number of patients on ECMO for cardiac failure in the 2 previous years, and, among them: number of patients who failed to wean from ECMO and not eligible for HT or VAD; number of patients withdrawn from ECMO despite relative stability; (2) medical and non medical justifications for withdrawal; (3) final decision-making process.

RESULTS. 9 centers responded. In the 2 previous years, ECMO was inserted in 306 patients (for a total of 629) for cardiac failure, 144 were weaned, 65 received HT or VAD. Among the 88 patients who died on ECMO, ECMO support was removed intentionally in 61 patients because multiorgan failure (70% of cases) or neurologic complications (20% of cases). Age was never considered as an important factor for withdrawal decision in 6/8 centers. A medico-surgical staff was *always* organized in 4/9 centers, *always* in presence of nurses and family in 4/9 and 6/9 centers respectively. The machine was *always* removed in presence of nurses in 4/9 centers and *sometimes* in presence of family in 4/8 centers.

CONCLUSION. It was observed in this preliminary survey a great heterogeneity of practices when withdrawal of ECMO was decided in patients with cardiac failure not expected to recover and contraindicated for HT or VAD.

0452

TIME FROM ADMISSION TO DEATH IN THE ICU

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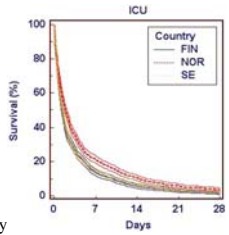
Internationally the reported ICU mortality varies, but often is reported to be in the range of 5–15% in large datasets. The time to death in the ICU is seldom explored. We wanted to explore the time (days) treated in the ICU before death in a large ICU admission sample.

METHOD. In a merged database from three Nordic national ICU registries (Finland, Sweden and Norway) data from 53305 ICU admissions from 2006 were analysed. Patients dying during their ICU stay were retrieved an analysed using Kaplan Meier survival analysis. Comparison of the groups was performed using several variables: age groups (<40; 40–80; >80), sex, severity of illness group, country and type of hospital (local; central/regional; university).

RESULTS. Overall 4854 patients died during the ICU stay (9.1%), Finland 8.6%, Sweden 8.1% and Norway 12.4%. The median time to death in the ICU was 1.5 days with range from 0 to 222 days. There was a significant longer time to death in Norwegian ICU (1.9 days) compared with ICU's in Finland and Sweden (1.3 days) Logrank test $P < 0.0001$) (Fig. 1). University hospitals had a longer time (1.6 days) compared with local and central/regional hospitals (1.3 days) (Logrank test $P = 0.2421$). A significant shorter time to death was found in patients >80 years (1.0 days) compared with younger patient groups (1.5 and 1.7 days) (Logrank test $P < 0.0001$).



Time to ICU death by country

CONCLUSION. This study confirms the previous reported ICU mortality rate also for three Nordic countries. Patients dying in the ICU stay in general a short time in the ICU before they die. Increased median time to death was found in Norway, and in the University hospitals. A shorter time could be demonstrated in the very old patient groups.